The Citrus Industry
EXCLUSIVE SPECIALIZED CITRUS PUBLICATION
Issued Monthly
Representative of every interest
Representing no special interest

Publication office at Bartow, Florida. Entered as second class matter February 16th, 1920, at the post office at Tampa, Florida, under the act of March 3, 1879. Entered as second class matter June 19, 1933, at the post office at Bartow, Florida, under act of March 3, 1879.

Study Of Gummosis And Psorosis

1. Gummosis
2. Scaly Bark

Showing Limitations of Bark-Scraping Method In The Control of These Diseases, As Reported in Paper Read At The Florida State Horticultural Society by Plant Pathologist of Cocoa Laboratory, Florida Experiment Station

Dr. Arthur S. Rhoads

The fact that psorosis in the early stages usually extends only to the middle layer of bark so that the inner bark and the cambium remain healthy for a time gave rise to the idea of endeavoring to control this disease by systematically scraping off the outer layer of diseased bark. When attention was called to this fact by Webber* in a brief note on this disease in 1902, he stated that he had observed it to yield to treatment by scraping off the outer diseased bark and applying crude carbolic acid. As a result of extensive trials started more than 15 years ago, Fawcett and others have reported marked beneficial results for this bark-scraping method of treatment of psorosis in California. It was also found to be of value in treating the shell-bark disease of lemons in that State. The experiments in California have shown the importance of scraping the bark not only over the area visibly affected, but also 6 to 8 inches above and below and from 4 to 6 inches on either side of the margin of the lesions in case they do not extend around the attacked trunk or limb. The scraping should be just deep enough to remove only the dark surface layer and expose the white inner bark. Too deep scraping is liable to result in the death of the inner bark and cambium layer. A large number of disinfectant applications have been tested in California, both with and without scraping, but a thorough job of bark scraping has been found to be much more important than the use of any kind of fungicide or disinfectant alone. Workers in other states and countries have likewise reported beneficial results from this method of treating psorosis. and also some forms of gummosis.

In the spring of 1927 the writer began work to determine the value of this bark-scraping method of treatment under Florida conditions, not only for the control of psorosis but also for the forms of gummosis on grapefruit and tangerine trees, which are very similar in many respects. Blocks of trees were selected in three medium-aged groves at Bonaventure and at Courtenay and Lotus on Merritt Island, where bad outbreaks of gummosis and psorosis occurred under a wide range of soil and other conditions. In the spring of 1928 the work was extended to include a block of groves at Cocoa on a still different type of soil. The trees in each block were mapped and descriptive notes taken on the condition and development of the disease on each tree at the time of treatment. Although the causes of these respective bark diseases were not known, it was thought that growers would be more interested at the start in anything which might offer a means of curing these troubles than in probably waiting several years to learn the exact causes and then possibly not having a practical remedy. It was also thought that by inspection of each diseased tree and treatment, where necessary, for a number of years an insight could be gained in regard to the rate of development, nature, behavior, and persistence of these bark diseases, which would prove of considerable value. Since it was not known at the time whether the treatment might prove effective in advanced cases of these respective bark diseases, all diseased trees in these grove blocks were included, regardless of the severity of the disease. The inspection and treatment of each of these trees, where

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* Letter on Psorosis in Hart, W. S. and Carter, J. C., Diseases and Insects of the Citrus. Florida State Hort. Soc. Proc. 15 (1902): 48.

Citrus Grove management

Citrus Management and Operation

And Their Influence on the Net Returns Received by Florida Citrus Growers As Discussed By Assistant Entomologist of the Florida Agricultural Extension Service....

R. H. Howard

I will attempt to point out the influence of different management and operation practices as revealed by grove records on net returns, and to enumerate production operations which seem profitable.

Perhaps, at the beginning, it's a good idea for me to emphasize that good grove management is a prerequisite to success in the operation of a citrus grove just as the management of any other business.

The average size of citrus groves in Florida is too small for owning and operating economically all necessary machinery and equipment. As a result, greater competition in the production of citrus fruits has caused the establishment of more and more production units, both commercial and cooperative. These large production units have facilitated greater purchasing power of equipment and materials used in production at a saving to the average grower. In recent years, production units have been operated in connection with packing and marketing organizations, which indicates a further advantage to the industry as well as to individual growers in obtaining better returns on their investments.

Growers have a tendency to cut the amount of fertilizer they use during low citrus price periods and this materially affects net returns by reducing yields. This reduction of yield is to be expected when we recognize the fact that for most citrus production in Florida the plant food must necessarily come out of the bag. Records since 1930 show that approximately 38 per cent of the cash expenses in grove care was for fertilizer, although there are indications that 50 per cent or more could profitably be spent for fertilizer on many groves. Of all the items of cost involved in production, on the average, the amount spent for fertilizer paid greater dividends per dollar invested than any other item of expenditure.

However, we should not lose sight of the fact that efficiency in the use of plant food elements is as important as any other phase of cultural care. Generally speaking, when fertilizer is referred to, only the principal elements, namely, nitrogen, phosphorous and potassium are implied. Nevertheless, we must not overlook calcium, magnesium, copper, zinc, and other elements which are important in feeding a citrus tree. In other words, it is something like a wagon wheel. Remove a spoke and the strength of the whole wheel is reduced. So it is with fertilizing a citrus grove: if one or more plant food elements are lacking, part of the value of other elements will be lost. Then, too, inadequate and unbalanced plant food increases dead wood, which increases the cost of pruning and reduces net returns.

Now, let's consider equipment. The most recent outstanding demonstration of efficient grove equipment is the method of disposal of cover crops.. Formerly, mowing machines were used to cut cover crops in the summer and fall of the year. A mowing machine is one of the most expensive pieces of equipment used in a grove if depreciation, repairs, interest on investment and work accomplished are taken into account. When mowed in the summer, the vegetative growth that is left tends to smother out the second growth. Not being incorporated with the soil, it decomposes very slowly and is consequently of little value in improving the fertility of the soil. In addition to these disadvantages, fall mowing also causes a fire hazard.

The expensive operation of mowing is being replaced now by the use of a rotary cutter. This machine is faster, more efficient, cheaper to operate, and on many groves, has materially reduced the cost of disposing of the cover crop in the manner for which it was intended — improving fertility and physical condition of the soil.

Other efficient and economical equipment for grove care include large tank sprayers, two and three bottom plows, fertilizers distributors, and rubber equipped tractors and trailors for transporting machinery to and from distant groves. These reduce labor, power, and equipment costs to a minimum and thereby increase net returns.

Pest control is a major factor in grove care. It should be practiced at the time when most good may be accomplished in preventing serious insect and disease damage to fruit or trees. In other words, it is a matter to be determined only by frequent and close inspection of the grove. In controlling insects and diseases, efficiency may best be determined by quality of fruit and physical condition of trees. Timely and efficient pest control will likewise be reflected in costs and net returns to owners.

Adequate plant food and tree pest control are equally important in time of low prices, such as prevailed this season, as in time of high prices. Insufficient plant food and ineffective pest control measures affect the yield over a period of years and reduce net returns to growers.

Now, we take up the matter of irrigation. It is needless to say that it costs to irrigate a grove, but lack of water on many groves is a limiting factor on yields. Frequently, large quantities of young fruit, and mature fruit, as well, are lost because of lack of water at the opportune time. Much fruit was lost this spring because of inadequate mois-

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ture, which, no doubt, will affect the yield to be marketed next fall and spring. According to the grove records, the **additional expense incurred for irrigation pays good dividends.** Factors to considered in equipping a grove with an irrigation system are size of unit, loss of fruit as a result of lack of water in previous years, and accessibility to water. The portable irrigation plants provide an economical means of getting small groves irrigated if water is accessible.

A few words about tillage practices. This phase of cultural care is somewhat like that of adequate plant food. No set practice could be followed for all groves. Nevertheless, a study of different methods of tillage pratices, such as, non-cultivation, partial and intensive cultivation, indicated that over a period of years intensive or frequent cultivation increased costs and reduced yields and net returns to owners. About all the cultivation that can be economically justified for most bearing groves planted on sandy soils is two cultivations a year—one in the spring to prepare seedbeds for cover crops and one in the fall to incorporate vegetative growth with the soil if the rotary cutter fails to do the job adequately. Fall cultivation also reduces fire and frost hazards. However, on those grove soils where moisture can be conserved during drouth periods, additional cultivation may be economically justifiable. Deep cultivation disturbs the root system and often causes parts of the tree top to die back, thereby increasing costs of pruning. The practice of hoeing bearing trees on sandy soils fails to reflect any beneficial effect on yield or net returns to owner, but it increases the cost of production.

I have endeavored to give you a brief resume of grove management and practices and their influence on net returns to the grower. Our findings are based on records kept by a number of grove owners over a period of several years. If you would like more detailed information see your county agent for a copy of "Florida Citrus Costs and Returns", also a study entitled "Some Factors Affecting Citrus Costs, Yields, and Returns" or write to the Agricultural Extension Service, Gainesville, Florida.

THE GROWER'S OWN PAGE

(Continued from Page 3)

made and the water was poured into these basins instead of those around the trunks. These basins were filled with water the same day as made and again the following night and the next morning the trees had come out of the wilt.

With this system a small amount of water can be made to do more good and more trees can be watered in a given length of time.

When the trees are set square it would be better to make the basin just inside the drip of the tree. Making the basin run completely around the tree or, what I believe would be just as effective, only make two basins with one on each side of the tree just under the drip.

Yours truly,
Thos. A. O'Mara.

Husband: "Have you ever wondered what you would do if you had Rockefeller's income?"

Wife: "No, but I have often wondered what he would do if he had mine."

After all, life is pretty well-balanced.

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STUDY OF GUMMOSIS AND PSOROSIS

(Continued from page 5)

necessary, was repeated each year through 1937, so far as they continued living or were considered worth retreatment, with the exception that in 1929 those in the grove at Courtenay were omitted on account of emergency work in the Mediterranean fruit fly campaign. Thus, with the exception of this grove and the one at Cocoa where the work was not commenced until 1928, the data in regard to the development and behavior of these bark diseases covers a period of 10 years following the initial treatment. As a rule, the inspections and retreatments were made in April, May, and June, but occasionally earlier. The final inspection of the trees in the groves at Cocoa, Courtenay and Lotus in 1937 was not made until late in August, so that more than a year elapsed between this and the previous inspection and retreatment.

It became apparent early in the work that the bark-scraping method of treatment had a decided practical value for the control of both gummosis and psorosis. However, it is never safe to judge the value of any method of treatment of such bark diseases until after a few years have elapsed. The importance of doing a thorough job of bark scraping, not only so far as the lesions extend, but also well in advance or their apparent limits, was demonstrated very conclusively early in the work. In cases where the lesions were not scraped sufficiently far in advance, both gummosis and psorois almost invariably continued activity. It has been the experience of the writer, in examining numerous trees treated by growers in different parts of the State, that they frequently do not get the results that may be expected from the method because they neglect this most important precaution. It has also been his experience that lesions which are not treated because they do not appear active, frequently resume activity a year or two later, as these bark diseases appear to remain quiescent for a time under certain conditions. Some growers in Florida prefer to remove the surface layer of bark with a wire bristle brush. When carefully done this appears to give very good results.

A considerable variety of disinfectant pastes and washes have been applied to scraped lesions to test their comparative value. Among these may be mentioned Bordeaux paste, lime and sulphur paste, lime-sulphur paste and washes, zinc sulphate-lime, caustic soda-Bordeaux, caustic soda-Bordeaux with lime-sulphur, Avenarius "Arrow" Carbolineum (a commercial carbolineum of low phenol content). Avenarius Dendrin (a commercial preparation emulsified to mix with water) at dilutions of 10 and 20 per cent and without dilution, Humisol and Preservital (two commercial beech wood cresosote preparations, the former emulsified to mix with water), Protexol (a commercial carbolineum), Black Sambo (a commercial material containing neat's-foot oil, formerly advertised in California). Nitrose paint (a commercial heat-resisting paint for preventing rust on metal), and "Gummosis No. 1," "Gummosis No. 2," and "Gummosis No. 3" (commercial preparations containing Venezuelian asphalt and also aluminum paint in one case).

The last four of these preparations did not have any particular value for the purpose but were not injurious. Both the Black Sambo and Protexol proved highly injurious, the latter certainly belying the implication of its name. Humisol and Preservitol, Avenarius "Arrow" Carbolineum, and Avenarius Dendrin did not prove injurious, even when used at full strength, but apparently were no more effective for the purpose than lime-sulphur. The various home-made pastes and washes enumerated all proved very satisfactory but lime-sulphur appeared to be the most effective in expediting scaling and exfoliation of the outer layer of bark, which is the object of the treatment. Thick, heavy, sealing materials tend to retard this process, and thus are not desirable. Moreover, such substances, particularly when black, have the additional disadvantage that they obscure the bark and render it difficult to see what is taking place. Owing to its apparent superiority, lime-sulphur was the principal material used. It has the additional advantages of being cheap, readily mixed for use, and available in all localities. By reason of the convenience of storing, the writer used the dry lime-sulphur, mixing it for use at the rate of ½ pound per gallon of water. Where the commercial liquid lime-sulphur is used it is recommended that it be diluted with about 6 parts of water since injury to the bark sometimes results from using it in more concentrated form.

The writer wishes to stress the fact that, as proved true in California, the application of a fungicidal paste or wash to the scraped areas of bark appears to be a matter of secondary importance in comparison to a thorough job of bark scraping. It is believed, however, that under Florida conditions of a moist, humid climate, with frequent periods of prolonged rainfall, such an application is of particular value for the prevention of infection of the newly scraped areas of bark by various organisms. Moreover, it is likely that a fungicidal paste or wash may prove of value in killing the various organisms or virus which may be associated with the diseased areas of bark. The writer has had occasion to observe over a period of several years gumming areas of bark painted with a variety of substances without first scraping the bark, but in no case has he observed any particular worthwhile results unless the material applied induced the outer bark to crack and scale off. It appears that it may be possible to accomplish a fair control of these bark diseases by the application, without extensive scraping or brushing, of some penetrating material that does not injure the inner bark. Within the last few years growers in some sections of the State have claimed beneficial results from spraying unscraped lesions with caustic soda-Bordeaux, an old-time fungicide used a generation ago in the Arcadia section for foot-rot control. In some instances they have added 5 gallons of commercial liquid lime-sulphur to the 5-5-50 formula. However, the writer has not had the opportunity to follow up these treatments in detail.

The value of the bark-scraping method for treating psorosis and our Florida forms of gummosis lies in the fact that the removal of the waterproof outer layer of bark induces the formation of a cork layer within the inner bark, which results in the drying out, cracking, scaling and exfoliation of the outer bark cut off by the formation of this internal cork layer, thus tending to eliminate the disease where it has not become too deep-seated. A superficial scraping of the bark suffices to accomplish this. While it is most important that the scraping be thorough in extent, it should never extend more than a third of the way through the bark.

The results of the bark-scraping method of treatment for gummosis and psorosis are summed up in the following:

Grove at Courtenay on Merrit Island

In this grove, all trees on which bark diseases were apparent in a block of 475 trees were treated, beginning in 1927. Inspection and re-

treatment, where necessary, was repeated each year until 1937 inclusive, with the exception of 1929. This block consisted chiefly of Pineapple oranges with some scattered Florida common grapefruit. With the exception of a few rows on grapefruit stock, all were on sour orange stock. The soil is Norfolk fine sand, in which the trees occasionally suffer more or less from drought. Psorosis occurred scattered throughout this entire block of 50 short rows and several trees exhibited bad cases of this disease in which the trees had begun to decline at the beginning of the treatment.

A total of 64 trees, comprising 52 oranges and 12 grapefruit were treated for gummosis and psorosis. Results obtained at the end of the tenth annual inspection and treatment in 1937 showed that, of the 52 orange trees treated for psorosis, 21 either had been removed or discarded as worthless because of decline from this disease. Within 4 years after the initial treatment, 15, or 71.4 per cent of these 21 trees, all of which had fairly bad to bad cases of psorosis to start with, were either removed or had declined to the point where they were no longer worth treating. It did not prove possible to cure a single one of these trees by the bark-scraping method of treatment.

On the other hand, the initial treatment in 1927 sufficed to arrest the development in most cases of the other 31 trees which had chiefly early to slightly advanced stages of psorosis. In many instances, however, new psorosis lesions developed later at points more or less remote from the areas treated originally. These later developments of the disease appeared to be the result of new outbreaks rather than cases of the disease persisting in the trees. In some instances the new outbreaks of the disease did not occur until 5 or more years after the original treatment. On some trees there was but a single new outbreak, while in others there were two or three. In nearly every instance these new outbreaks of the disease occurred in the crotches of the limbs or trunk divisions, which seems to be a common place for psorosis to start. As in the case of the lesions originally treated, the development of these new lesions appeared to be readily checked in most cases by a single treatment. One of these trees, which had but two small lesions in limb crotches to start with, was removed in 1936 on account of decline from blight, after the psorosis had been controlled. At the conclusion of the experiment with the tenth inspection in 1937, only a single one of the 30 orange trees remaining required retreatment and this exception was due to a recent new outbreak of psorosis. Of the 29 orange trees not requiring any retreatment at the tenth inspection in 1937, 2, 7, 1, 1, 3, 1, 4, and 10 had not shown any need of treatment for the past 1, 2, 4, 5, 6, 7, 8, and 10 years, respectively. The results of the treatments for the orange trees in this block of grove are summarized in Table 1.

Of the 12 grapefruit trees treated in this grove in 1927, 3 appeared to have typical cases of psorosis and the other 9 gummosis. Of the 3 grapefruit classed as having psorosis, two, each of which had a prominent lesion on a main limb in 1927, were removed in 1937 on account of decline from this trouble. The other, which had only a small lesion on the trunk in 1927, was discarded as hopeless in 1933 and removed on account of decline from psorosis in 1935. For some unknown reason the disease progressed in this tree with unusual rapidity. Of the 9 grapefruit classed as having gummosis, one had 3 lesions and the others each a single small lesion in 1927. In a few of these the disease appeared to be checked and then broke out again intermittently. One of these remained free from the disease for the last 2 years of the experiment, 1 for the last 3, 1 for the last 4, 3 for the last 7, 1 for the last 9, and 1 since the original treatment. The other remained free from gummosis for 6 years and then was removed on account of decline from blight in 1937.

During the 11-year period covered by the inspections and treatments, 35 additional trees, comprising 9 grapefruit and 26 orange, in this block of grove were added to the list of trees being treated for gummosis and psorosis. In some of the grapefruit trees the trouble appeared more typical of gummosis than of psorosis, but in the balance of the grapefrut trees and all of the orange trees it appeared to be typical of psorosis. In most cases but slight outbreaks of the disease occurred, but in a few rather advanced cases of the disease had developed. The treatment of these trees began as follows: 2 in 1928, 4 in 1930, 14 in 1931, 4 in 1932, 4 in 1933, 1 in 1935, 4 in 1936, and 2 in 1937. Of these 35 trees a single tree each of grapefruit and orange was removed on account of decline from psorosis. The former, in which the disease was first noted in 1931, was removed in 1937; the latter, in which the disease was first noted in 1930, was removed in 1936. As in the case of the trees originally treated in this block of grove for psorosis, a few required additional scraping where the disease was not checked completely by the first treatment, and in several new outbreaks of the disease appeared in limb crotches at points other than where the originally treated lesions developed, from one to five years after the disease appeared to be completely checked by the original treatment. Of the trees treated prior to 1937, with the exception of 4 trees on which active lesions of the disease were apparent in the final inspection of this year, all appeared to exhibit complete control of the disease. In 16 of these no further treatment was required since the original treatment. One of the trees in which the disease was still active was a replant in which a well-developed case of psorosis appeared at two points on limbs near the base of the crown in 1936. This tree had been set out to replace a tree that had been removed on account of decline from blight and could not have been planted for more than 4 or 5 years at most when the disease was first noted in 1936. Cases of psorosis are of very rare occurrence on such young trees. In the instance cited the disease undoubtedly had already become systemic and impossible to control.

While it did not prove possible to cure a single one of the trees in this

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TABLE 1—Summary of 10 years' treatment of 52 orange trees for psorosis in grove at Courtenay on Merritt Island, beginning in 1927

Year of inspection and retreatment	1928	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	52	48	43	37	36	32	31	31	30
Trees not requiring retreatment	23	26	27	28	29	31	21	28	29
(Percentage)	or 44.2	or 54.2	or 62.8	or 75.7	or 82.2	or 96.9	or 67.7	or 90.3	or 96.7
Trees retreated because disease not checked by prev. treatm't	27	14	4	6	2	0	0	0	1
Trees retreated because of lesions developing at new points	2	4	6	2	1	0	10	2	0
Trees removed or discarded on acc't of decline from psorosis	4	5	6	1	4	1	0	0	0
Trees removed or discarded on acc't of decline from blight	0	0	0	0	0	0	0	1	0

The Citrus Industry

with which is merged The Citrus Leaf
Exclusive publication of the Citrus Growers and Shippers

Publication office 550 North Broadway, Bartow, Florida
Telephone ____ 269

Published Monthly by
ASSOCIATED PUBLICATIONS CORPORATION
S. L. FRISBIE - - - - - - - - President
S. LLOYD FRISBIE - - - - - - Secretary-Treasurer
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Subscription, $1.00 per year in advance

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TEXAS PROPOSES AMENDMENTS TO SHIPPING PROGRAM

A hearing was held at Weslaco, Texas, on June 27, at which amendments to the citrus program which the growers and shippers of Texas have been operating since July 1937 were discussed.

Among the amendments proposed to the agreement program are a change from the three-year to a two-year base for handlers choosing past performance as a method of computing allotment bases; computation of new handler allotments on the basis of the quantity of fruit under control; interchange between handlers, of interstate and intrastate shipping allotments; weekly reports from shippers; and Federal - State inspection during periods when grade and size regulations are operative.

Following the hearing the proposed amendments were submitted to the Secretary of Agriculture for tentative approval.

Growers will vote on the proposed amendments to the program in a referendum to be held following tentative approval and at the same time the amendments will be submitted to shippers for their signatures.

An order making the proposed amendments applicable to all handlers can be issued by the Secretary of Agriculture if he finds that such action is favored by two-thirds of the growers, by number and volume, voting in the referendum and if 50 per cent of the shippers, or shippers representing 50 per cent of the volume of citrus fruit sign the agreement.

A marketing agreement similar to that indicated by the proposed amendments to the Texas agreement is being urged by a number of citrus factors in Florida.

GRAPEFRUIT—PRODUCTION AND PRICE

According to figures released by the Florida State Agricultural Extension Service, grapefruit production in Florida for the three-year period beginning with the 1920-21 crop averaged 6,851,000 yearly and the on-tree price to the grower averaged $1.29 per box.

For the three-year period beginning with the 1935-36 crop, the Florida production of grapefruit exceeded 14,000,000 boxes annually, with an on-tree price of slighty over 65 cents per box.

Thus, while the production a little more than doubled, the price received by the grower dwindled one-half.

Confronted with this situation, Florida grapefruit growers must bestir themselves to create new avenues of consumption if they are to receive anything like adequate returns for their fruit. Lower transportation rates will help; orderly marketing will help; but the real solution lies in increased consumption — and increased consumption will come only through intensive, sustained and efficient promotion campaigns and the judicious use of printer's ink.

AN IMPORTANT ORGANIZATION

At the recent annual meeting of the Growers' and Shippers' League of Florida, held in Orlando, on June 8, President R. B. Woolfolk in his annual address cited many of the important accomplishments of the League, which he says have meant a saving of hundreds of thousands of dollars to the citrus and vegetable growers of the state.

Figures submitted by the traffic manager, and quoted by Mr. Woolfolk in his annual address, show that for every dollar contributed to the support of the League, Florida growers and shippers have benefitted to the extent of $28.00 in savings in freight rates.

Through the efforts of the League, the proposal of carriers to increase the rate on fruits and vegetables by 15 per cent was denied and an increase of 5 per cent only was allowed by the Interstate Commerce Commission, which was real achievement for the League and for Florida growers and shippers.

Giving full credit to his fellow-officers, directors, committees and employees of the League, President Woolfolk made a strong plea for the continued support and co-operation of Florida growers and shippers, that the League may be in position to continue its good work on behalf of the agricultural and horticultural interests of the state.

A FINE RECORD

Few organizations during the past year of the "recession" have been able to liquidate their loans in advance of the due date, and when an instance of this kind occurs it is worthy of congratulation and commendation.

The Tree-Gold Co-Operative Growers of Orlando secured a loan of $200,000 from the federal bank at Columbia, on a three-year payment basis. One year after the loan was secured, it was paid off in full — two years in advance of the due date.

Only efficient management and good business practice could have accomplished this feat during the past season when citrus prices were at low ebb. The organization is entitled to congratulations.

Oil as insecticide

Different Methods of Oil Application

Results Obtained in Fight for Control of Scale Insects on Citrus as Reported in Paper Read Before Recent Meeting of Florida State Horticultural Society by Associate Entomologist, Lake Alfred Citrus Experiment Station . . .

W. L. Thompson

In the procedure of insect control on citrus trees, in commercial as well as in the research field, the results sometimes vary so much with the same materials that inquiries rise as to what factors may cause such variations. Some of the most common factors which are thought to be the causes of variations are weather conditions, type of trees, the time of year, kind of water used to dilute the spray material, coverage of the tree with the insecticide and the degree of infestation. Only two of the above listed factors will be discussed in this paper: namely, coverage of the tree with the insecticide and the degree of infestation.

When the control of any insect is contemplated one of the first considerations should be to determine the location on the plant where most of the insects feed and whether a contact insecticide or a stomach poison is needed. As it happens, practically all of the insects and mites infesting citrus must be controlled with a contact insecticide. The locations of the major insect pests are as follows: Purple scale on leaves fruit and limbs; Florida red scale on leaves and fruit; whiteflies on leaves; mealybugs on leaves, fruit and limbs; rust mites on leaves and fruit; purple mites on leaves and fruit; six-spotted mites on leaves only. As noted above, all of the major insects infest the leaves and, with the exception of the purple mites, there are usually more of any one of the above named insects found on the under surface of the leaves than on the upper surface. Since the control of only scale insects is discussed in this paper, figures on other insects will not be presented.

On the average there is a much higher percentage of purple and Florida red scale found on the under surface of the leaves than on the upper surface. The exception to that statement may be in groves where the infestation is light and some residual spray has been applied that that no insecticidal value, or on leaves that have a coating of "sooty mold." Not only are the heavy scale infestations found on the under surface of the leaves but the most heavily infested leaves are found on the inside of the trees, especially in those trees that have dense outside foliage. In one experiment, seven out of eight trees had more purple scale on the under surface of the leaves than on the upper surface. In four different experiments, fourteen out of seventeen plots had more purple scale on the under surface of the leaves than on the upper surface. Those counts were made from three different experiments at Lake Alfred and one experiment at Vero Beach. All of the thirty-six trees in one experiment had more scale on the inside leaves than on the outside ones. A comparison of the degree of infestation of inside and outside leaves of the same trees can be made in Table I. The scale infested leaves are not only found in the inside center of the tree but they are found near the top of the tree as well. In one row of eight trees about fifteen feet high, the infestation was as heavy near the top of the tree as it was in the center.

Many growers depend on the entomogenous fungi to control the scale but we find a very small percentage of the scale on the under surface of the leaves attacked by the fungi. During the past year counts were made from over 20 plots in five different groves and in no case was there as high a percentage of scale attacked by fungi on the under surface of the leaves as on the upper surface. Due to the fact that most of the scale insects are on the under surface of the leaves and the more heavily infested leaves are on the inside of the tree, it is necessary, although rather difficult, to obtain a thorough coverage of all the leaves with the scalecide for satisfactory control.

TABLE I

Heavy and Light Infestations of Purple Scale on Individual Trees

Average number of Living Scale per Leaf					
Outside Leaves			Inside Leaves		
Before Spray	After Spray	Per Cent Decrease	Before Spray	After Spray	Per Cent Decrease
99	27	73	219	46	79
43	15	65	192	48	75
41	14	66	167	44	74
30	15	50	186	20	89
14	7	50	154	21	86
6	3	50	102	24	76
8	3	62	45	3	93
5	.8	84	61	1.6	99
5	.4	90	56	.2	99
4	.2	95	18	1	94

Spray was applied from inside and outside of all trees.

The above findings of the location of the heavier populations of scale are by no means new information. In 1922 W. W. Yothers stressed the importance of thorough coverage of the under surface of the leaves for insect control in the U. S. D. A. Farmers' Bulletin No. 933. In a Florida Agricultural Experiment Bulletin No. 288, published in 1935 by your speaker, it is stated that purple scale, whiteflies and rust mites are found more abundantly on the under surface of the leaves and that thorough coverage was necessary for control. In 1935 at a meeting of the Florida Entomological Society, L. W. Zeigler presented concrete comparisons of the location of purple scale population on the tree, showing more scale on the under surface of the leaves than on the upper surface, as well as showing that the

population was more dense on the inside of the trees. Results obtained by your speaker on more recent purple scale counts follow closely the findings of Mr. Zeigler. Nevertheless, with all that has been done and said about thoroughness of coverage, a high percentage of the insecticides are still being sprayed on the upper surface of the leaves and on leaves near the outside of the tree.

Last summer some preliminary experiments were conducted at the Citrus Experiment Station to determine what some of the weak points of our spraying methods might be. In those experiments the three phases considered were methods of application of the scalecide, the types of trees to be sprayed and the types of spray guns.

Methods of Taking Data and the Description of the Experiments

The experiment was conducted in a 14 year old grapefruit grove where the average height of the trees was 12 feet, with a lower limb spread of approximately 14½ feet. Some of the trees had a dense covering of foliage with and without a crop of fruit while other trees had medium to sparse foliage. The infestation of purple scale in all plots ranged from light infestations to very heavy ones.

Each plot consisted of a single row of eight trees but in order to help account for variations each tree was considered individually, in other words, a scale count was made from leaves collected from each individual tree. Individual scale counts were made from leaves collected from the outside of the tree and also from the inside. Leaves designated as outside leaves were collected by the man picking the leaves from the outside and not more than an arm's length into the tree. Inside leaves were those collected from the central portion of the tree. "Low leaves" were those collected within three feet of the ground and "middle leaves" were those collected three to six feet from the ground. The leaves were picked at random as much as possible, but since none of the current year's leaves were collected, strictly random picking was not practical. There were several reasons for collecting only the older leaves. The current year's leaves had very few scales on them and since the older foliage was the source of infestation and more difficult to reach with the spray, only the older ones were considered. In one experiment fifty leaves were collected from the outside limbs of each tree and thirty leaves from the inside. When the experiment was repeated in October and all leaves were considered, 100 leaves were picked from each designated area. The leaves were collected in paper bags and the scale counts were made in the laboratory. The leaves in each bag were mixed and drawn out at random in lots of ten. The scale were counted from only one-half of each leaf, the upper and lower sides of the petiole end of the leaves were examined for scale. Counts were made before the application and again about five weeks afterwards.

On June 29 the trees were sprayed with an oil emulsion 1¼ per cent oil concentration. The same man sprayed all of the trees and where direct comparisons were to be made, all trees were sprayed from the same load. A power sprayer operating at approximately 500 pounds pressure was used. Some of the trees were resprayed in October for a second experiment but the same procedure was followed as in the first experiment.

Methods of Spraying

The type of trees to be sprayed determines to some degree the method of application. It is difficult to get under or inside of a 10 to 15 year old tree if it has rather dense foliage or if the lower limbs are close to the ground, but nevertheless, it may pay to take a little more time to do that than to get unsatisfactory results with the maximum amount of material. Last summer your speaker was in a 10 year old grapefruit grove where the trees had a dense covering of foliage. Those trees were receiving between 12 and 15 gallons of an oil spray, yet the coverage of inside leaves was not thorough enough to obtain a satisfactory control of scale. The spraying was all from the outside with the idea that the force of the spray would turn the leaves, but a very small percentage of the inside leaves were wet on the under surface.

Some of them were damp but it was doubtful whether there was enough oil deposited to be effective. Most of the trees in the experiment at the Station were low headed and it was necessary for the operator of the spray gun to get down on one knee to spray the inside of the tree.

In the first experiment two methods of application were used, namely, the outside spraying and the outside and inside spraying. The outside spray job was accomplished by the operator spraying the trees from the outside but attempting to reach the inside leaves by sticking the spray gun through the openings in the foliage and swinging the gun around to hit all sides of the tree. The outside and inside method was for the operator to spray the inside of the trees from the inside and then give the outside a fast brushing spray.

Where the spray was applied from the inside and outside compared to the outside method, a 26 per cent greater reducion of living scale per leaf with only 10 per cent more material was obtained. On individual trees there was less difference where the foliage was sparse than where it was dense.

TABLE 2.
Method of Application

	Gallons per tree	Per cent decrease of living scale
Outside spraying	8.0	58
Outside and Inside Spraying	8.8	84
Check		+ 21

In another experiment where the two methods were compared on Pineapple orange trees which were rather sparse of foliage, there was practically no difference in control between the outside and inside spray and the outside spray. The smaller orange leaves compared with the larger grapefruit leaves may also have been a factor in obtaining a more thorough coverage on the oranges.

As stated above, some of the trees in the grapefruit grove were heavily infested and those trees were resprayed in October and the two

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methods of application were repeated. At that time none of the trees had so much foliage on them as they did in June and there was not so much difference in results. At that time there was a very low percentage of the scale on the upper surface of the leaves so in two plots the trees were sprayed from the inside only. During the period between the time the oil sprays were applied and the time the scale count was made, a heavy leaf drop occurred in the sprayed plots as well as in the unsprayed one which influenced the per cent of reduction of the scale population. There was a decrease of 49 per cent in the check, or unsprayed plot, compared to a 76 to 89 per cent decrease in the sprayed ones.

There was a reduction of 89 per cent of living scale on trees sprayed from the inside and outside, 84 per cent reduction from inside spraying and 76 per cent reduction with outside spraying. The point to be illustrated here is that where a very low per cent of the scale was on the upper surface of the leaves there was almost as good control obtained from the inside spraying as with the combination of inside and outside spraying.

Going back to the June experiments there were some other interesting data obtained. There was 10 to 15 per cent less reduction of scale on heavily infested trees than on lighter infested ones, but where an 80 per cent reduction was obtained on leaves that had 200 scale per leaf there were still 40 scale per leaf which is too many unless a second oil is applied. Where there were 100 scale per leaf and an 80 per cent reduction was obtained, or 20 living scale per leaf remaining, the carry-over was only half as much but even so, 20 scale per leaf is still too many. Where the initial infestation was only 50 scale per leaf and a 95 per cent reduction was obtained only 3.5 scale per leaf remained. It can be easily understood why it takes two applications of an oil spray to reduce the scale infestation to a minimum if the scale are allowed to build-up heavy populations on the leaves. See Table 1 for comparisons of control on heavy and light infestations.

Another interesting point was that in 9 out of 10 trees there was more of a reduction of scale on inside leaves than on outside ones. All of those trees listed in Table 1 were sprayed from the inside as well as from the outside. The inside leaves received a more thorough coverage because of the sparse foliage compared to the denser foliage on the outside canopy of the trees.

The factor of dense outside foliage preventing thorough coverage especially when the tree had a crop on it, was well demonstrated from the results in one plot. The decrease of scale control varied with the amount of foliage and crop on the tree. There was a low percentage of kill on trees with a crop of fruit and medium to dense foliage. If the tree had rather dense foliage and no crop of fruit the percentage of kill was higher, and where the foliage was sparse and no fruit, a high per cent of kill was obtained (see Table 3). The oil spray was applied on June 29th and by that time the fruit was fairly good sized and the weight of it compacted the foliage to such an extent that a good coverage was not obtained on those trees. It is quite possible that a much more satisfactory control could have been obtained had the spray been applied a month sooner or before the fruit had grown to the extent that the limbs were bending.

Another weak spot in our application was the lack of coverage on low limbs, that is, on limbs from the ground up to three feet., In 9

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out of 12 plots, or 75 per cent, there was a higher per cent of kill on the leaves of middle limbs than on the lower ones. In a count of scale from individual trees there was a higher per cent of kill on the middle leaves than the lower ones in 29 out of 40 trees or about 72 per cent.

The results obtained from those experiments indicate that satisfactory control of scale might be obtained if control measures are taken before a heavy infestation has built up and a practice made of more spraying from the inside of the trees, especially where there is dense foliage and a crop of fruit.

Type of Spray Guns

The type of spray gun used was also a factor in the control obtained. Some of the results may not have been so much the type of gun used, however, as the size of disc in the gun. In the first experiment four different types of guns were used—the double Boyce gun which had two nozzles and could be regulated to spray a wide mist or a more narrow stream with more force, the single gun which could also be regulated, the four-nozzle broom gun and a 4-foot rod with two angular nozzles.

TABLE 3
Purple Scale Control on Different Types of Grapefruit Trees in the Same Row

Type of Foliage	Size of Crop	Aver. No. of Living Scale per Leaf Before Treatment	Per Cent Decrease After Spray
Dense	Light	29	73
Dense	Fair	14	53
Dense	Medium	10	10
Fairly Dense	Med.	4	32
Fairly Dense	Med.	3.2	19
Fairly Dense	Good	.8	25
Sparse	Light	2.6	92
Sparse	None	2.8	97

Oil spray applied June 29, 1937.

In Table 4 are shown the results obtained where the different kinds of guns were used. The highest percentage of kill was obtained where the double gun was used. The single gun rated third, but a small disc was used. In a later experiment when a larger disc was used in the single gun, there was little difference in results between plots sprayed with it and the double Boyce gun. The four-foot rod gun with the two angular nozzles was fairly satisfactory, but was too hard to handle. Nevertheless, in a test made at Vero Beach a more satisfactory control was obtained on trees sprayed by the old type of bamboo rods than with either the double gun or the broom gun.

The lowest percentage of kill was obtained with the four-nozzle broom gun at Lake Alfred as well as at Vero Beach. It is quite possible that if the nozzles were set at an angle and large enough discs were used on the broom gun, a more thorough coverage could be obtained. The nozzles are set at an angle on many of the broom guns in use but no data were obtained for comparisons. There is need for improvement in our spray guns as well as more knowledge of the proper size disc to use with the different types of guns now in use. If small discs are used in the broom type of gun it is doubtful whether enough spray will be deposited to be effective on leaves near the top of the trees. If large discs are used, more material than is necessary is likely to be used if careful spraying is practiced. Larger discs can be used to advantage in the single or double type of gun without so much waste as the number of nozzles are cut down and they are more easily handled on the inside of the trees, the stream or spray can also be regulated on those guns.

If more thorough spraying is practiced, that is, thorough spraying from the inside of the tree, some caution should be used in the amount and kind of materials used, especially with oil sprays. If a quick breaking oil is used, the operator should not keep the gun directed at any one part of the tree for any length of time since a heavy deposit of oil will accumulate and may injure the foliage and twigs. The grower should consult the salesman or field man representing the company manufacturing the oil as to the specifications and kind of oil that is being purchased.

TABLE 4
Control of Purple Scale With Different Type of Spray Guns

Type of Gun	Size of Discs	Gallons per Tree	Per Cent Decrease of Av. No. of Living per Leaf	No. Seconds to Spray Av. Tree
2 Nozzle Rod	3/64	8.7	74	210
4 Noz. broom	2-2/64 2-3/64	8.6	67	138
Double Boyce	6/64	8.8	83	108
Single Gun	5/64	6.5	65	336
Check			+21	
Second Experiment				
Double Boyce	6/64	9.2	82	130
Single Gun	8/64	12.0	88	150
Check			49	

Experiencing considerable losses in their groves during the recent drought, many Highlands county growers are now making plans to install irrigation systems so as to be ready for an emergency of this type when it occurs again, according to County Agent Louis Alsmeyer of Sebring.

Acreage devoted to permanent pastures in Hardee County this year will be larger than last year's according to County Agent H. L. Miller of Wauchula.

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Citrus Rust mite

Control Measures for Rust Mites

Recommendations Offered by Prominent Entomologist For Combatting Assaults of Rust Mites, 6-Spotted Mites and Red Spiders, Also Discussion of Damage Caused By These Devastating Citrus Pests.

J. R. Watson

The mean temperature of March, April and May here at Gainesville was more than five degrees above normal. These conditions, we believe, were general over the peninsular portion of the state where citrus is grown. This has resulted not only in a rise of rust mites in our groves but also in a heavy infestation of the 6-spotted mite in many sections. Fortunately the control of the 6-spotted mite and the rust mites may be combined in a single spray.

The 6-spotted mite attacks especially grapefruit. It congregates in large colonies on the undersides of the leaves, from which it sucks the sap, causing these spots to turn light yellow in color, and if the infestation is heavy, the leaves will drop. Needless to say, the dropping of these young leaves at this time of the year is a serious drain on the vitality of the trees, and may result in the dropping of fruit. Already reports have come in that as many as half the leaves have dropped from some grapefruit trees. The situation is sufficiently serious that our growers must be on the lookout for 6-spotted mite, particulary on grapefruit, and if abundant the trees should be sprayed at once. Yellow spots on the leaves, especially young leaves of this year's growth are the most visible signs of the mites but one with good eyes can see the mites themselves on the undersides of the leaves and the use of a hand lens magnifying about ten times will make them readily visible. They are pale yellow in color, with six rather indistinct marks on the body.

The purple scale mite is rather common at the present time. This, is of a reddish color and unlike the 6-spotted mite, is more apt to attack the upper sides of the leaves, which instead of turning yellow in spots turn an ashen gray, losing the bright green luster of a healthy leaf. This mite too can be controlled with the same spray.

The control of all three of these pests, like most members of the spider family, calls for the application of sulfur in some form:—the elemental sulfur itself or some of its compounds, usually lime-sulfur or wettable sulfur. It can be applied either as a dust or a spray. Which of these the grower will find the more economical will depend upon many factors, including the size of his grove, his equipment, the weather and which of these three pests he finds most on the trees at the time.

Dusting will be effective for rust mites but for the red spiders, both the purple mite and the 6-spotted mite, spraying will be more effective,particularly if the weather should turn off somewhat cooler. The big advantage of dusting is the rapidity with which it can be applied. This appeals particularly to owners of large groves. It enables them to cover their groves quickly and thus gain control of rust mites at the beginning of the infestation. Usually one with a power duster can cover his grove in about one-tenth of the time it takes to spray, although this will depend upon how handy water is. Of course, with the use of an airplane this time can still further be reduced. However, if the application of a dust is followed in about three days by a heavy rain, one does not ordinarily get as good control of rust mites as with a spray, since the dust is more easily washed off. Furthermore, one cannot satisfactroily dust if much wind is blowing.

(Continued on page 18)

Following the advice of County Agent N. H. McQueen, many Charlotte County growers are now seeding leguminous crops such as velvet beans, cowpeas, sesbania, and crotalaria on lands to be used for crops in the future. These cover crops have proven very satisfactory in increasing yields on lands where they have been used in the past.

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STUDY OF GUMMOSIS AND PSOROSIS

(Continued from page 9)

block of grove which had fairly bad to bad cases of gummosis or psorosis to start with, the success of the bark-scraping method of treatment in nearly all cases of both these bark diseases, where they were still in an early to slightly advanced stage when the treatment was begun, was very gratifying.

Grove at Lotus on Merritt Island

In this grove all trees in which bark diseases were apparent in a block of 12 rows of 17 trees each were treated, beginning in 1927. The trees treated comprised 54 grapefruit, 59 tangerines, 3 mandarins, and 8 oranges. With the exception of the grapefruit, most of which was on grapefruit stock, all the trees were on sour orange stock. The soil is chiefly Gainesville and Dade sands, underlaid by coquina limestone. Several trees, chiefly in the tangerine block, had been removed and replanted on account of decline from blight when the work was begun.

Of the 54 grapefruit trees treated in this block of grove in 1927, all the bark disease appeared to be typical gummosis. Forty-nine of the cases were classed as slight to somewhat advanced, with the number of lesions varying from 1 to 5 on the trunk and main limbs. The gummosis on the remaining 15 trees was classed as bad on 3 and moderate on the others. In many instances gummosis had developed about the callus formed over old, more or less completely healed, pruning wounds. In these cases the wood did not appear to have been protected and nearly all wounds showed more or less evidence of decay. The majority of these trees required retreatment in 1928. In the subsequent years, however, only a few of these trees required retreatment because of activity of the disease in the original treated lesions, although a number required retreatment because of gummosis developing at new points. In 2 trees no retreatment was required during the entire 10-year period after the original treatment in 1927, and in 6 trees no retreatment was required after the first one in 1928. In the other trees the disease showed activity, either at old or new places, intermittently in one or more years, sometimes after a few years of inactivity. During the 11-year period covered by the experiment, 10 of the treated grapefruit trees were removed as follows: 1 in 1928 as a result of root rot and decline following water injury, 4 in 1933, 3 in 1934, and 2 in 1937 as a result of decline from blight. None of the latter 9 trees exhbited bad cases of gummosis.

Of the 44 grapefruit trees remaining at the conclusion of the experiment in 1937, 31 showed no evidence of gummosis, 5 were retreated because of new outbreaks, and 8 were retreated because of gummosis being active at places treated previously. Only one of the latter group of trees appeared hopeless and that was one in which gummosis was just starting from a series of tiny holes in the main limb crotch when the initial treatment was made in 1927. In this case bird shot were found imbedded in the wood and the grower recalled having fired his shotgun one night at a pestiferous cat. The gumming advanced rapidly on this tree despite the treatments, which were required each year except 1931. After a few years the entire trunk became involved by the disease and the bark died on one side and the wood became extensively discolored. The results of the treatments for the block of grapefruit trees in this grove are summarized in Table 2. With the exception of the tree just cited, the bark-scraping method of treatment appeared quite beneficial in controlling gummosis.

Of the 59 tangerine trees treated in this grove in 1927, practically all had extensive cases of gummosis, involving much of the lower trunks and the bases of the main trunk divisions. In many instances lesions occurred also at points higher up on the limbs and the majority of these trees required extensive treatment. All of these trees likewise required retreatment at one or more points in 1928 and many of them required extensive retreatment. Of the 57 trees remaining in 1929, all but 2 required retreatment because of the continued activity of what appeared to be the original lesions. In the succeeding years the progress of the disease appeared to be well checked where first treated but frequently the disease continued to be active at some point or points at the margins of previously treated lesions or at new places. In the fourth inspection and retreatment in 1931 it was observed that new bark infections frequently began to develop in the old healed bark of the lesions first treated in 1927. The reduction of the number of trees requiring retreatment each year was largely minimized by both this and the development of lesions at new points, chiefly on the upper limbs where the disease did not occur previously. As a result of the frequent outbreaks of this disease at new points and its reoccurrence 3 to 4 years later in the older areas previously treated, most of the trees that were not removed on account of decline from blight continued to require retreatment each year, despite the progress of the disease being nicely checked in most of the areas previously treated.

In the analysis of the results it was found that 8 trees required retreatment each year from 1928 to 1937 inclusive because of activity at one or more points that had been treated previously. In fact, most of the trees required retreatment each year since the original treatment in 1927, so far as they did not succumb to decline from blight, either because of failure of the previous treatment or treatments to control the disease or on account of bark infections developing at new points not previously treated. Only in a few instances did trees go for two consecutive years without requiring retreatment and only two trees went for more than 3 consecutive years without requiring retreatment. One of these required no retreat-

TABLE 2—Summary of 11 years' treatment of 54 grapefruit trees for gummosis in grove at Lotus on Merritt Island, beginning in 1927.

Year of inspection and retreatment	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	54	53	53	53	53	53	49	46	46	46
Trees not requiring retreatment	14	36	32	46	42	38	30	34	39	31
(Percentage)	or 25.9	or 67.9	or 60.4	or 86.8	or 79.2	or 71.7	or 61.2	or 73.9	or 84.8	or 67.4
Trees retreated because disease not checked by previous treatment	39	7	8	4	5	6	5	8	4	5
Trees retreated because of lesions developing at new points	0	10	13	3	6	5	11	4	3	5
Trees removed or discarded on account of decline from psorosis	0	0	0	0	0	0	0	0	0	0
Trees removed or discarded on account of decline from blight, etc.	1	0	0	0	0	4	3	0	0	2

ment for the last 8 years of the experiment and the other required none for 5 consecutive years and then was removed on account of decline from blight. The results of the treatments for the block of tangerine trees in this grove are summarized in Table 3.

TABLE 3—Summary of 11 years' treatment of 59 tangerine trees for gummosis in grove at Lotus on Merritt Island, beginning in 1927.

Year of inspection and retreatment	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	59	57	57	57	55	53	52	45	45	44
Trees not requiring retreatment	0	1	10	7	8	3	2	4	10	7
	or	or	or	or	or	or	or	or	or	or
(Percentage)	0	1.8	17.5	12.3	14.5	5.7	3.8	8.9	22.2	15.9
Trees retreated because disease not checked by previous treatment	57	55	36	44	41	35	39	41	28	33
Trees retreated because of lesions developing at new points	0	1	11	4	4	14	4	0	6	3
Trees removed or discarded on account of decline from psorosis	0	0	0	0	1	0	0	0	0	0
Trees removed or discarded on account of decline from blight	2	0	0	2	1	1	7	0	1	1

With the exception of a single tree, whose loss possibly was attributable to the bark disease and the 15 that declined from blight, these tangerine trees continued to be very productive throughout the 11-year period covered by the experiment. The treatment proved very effective in checking the disease but new gumming areas developed so rapidly that the results make a very poor showing when considered from the standpoint of the repeated retreatments required. The few mandarin trees in this block of grove appeared to be much more resistant to this bark disease than the tangerines.

Of the 8 orange trees treated for psorosis in 1927, all but one exhibited only early stages of this trouble. Three of these trees required no further treatment during the next 10 years they were under observation. Another required only a little additional retreatment in 1928 to check the development of the disease. In two other trees where the original treatment arrested the disease, one required retreatment in 1933 for a small lesion that developed at a new place, and the other required retreatment in 1930 and again in 1931 for the same reason. Still another tree required retreatment in 1929 and was removed the following year on account of decline from blight. The remaining one of these 8 trees, in which psorosis involved the small trunk and extended up on the main limbs, exhibited no further evidence of the trouble after the first treatment in 1927, but was removed in 1935 on account of decline from blight. In the few orange trees treated for psorosis in this block of grove the bark-scraping method of treatment proved very effective.

During the 11-year period covered by the inspections and treatments a total of 13 trees, comprising 8 grapefruit, 1 mandarin and 4 orange, were added to the list of trees being treated in this block for gummosis and psorosis. The treatment of these began as follows: 1 in 1929, 2 in 1930, 2 in 1931, 1 in 1932, 1 in 1934, 3 in 1935, and 3 in 1937. The orange trees each had developed slight cases of psorosis in crotches of the main limbs, which appeared to be checked readily by the treatment, despite the disease developing later at new points on some of the trees. One tree, however, was removed in 1933 on account of decline from blight. The gummosis lesion which developed on the mandarin tree in 1931 required but the initial treatment to check it. The treatment also appeared to be quite effective in checking all but one case of gummosis developing on the grapefruit trees. Extensive cases of typical psorosis were noted for the first time in 1937 on 2 grapefruit replants.

Grove at Bonaventure

In this grove of about 6 acres, 83 trees in which bark diseases were apparent were treated, beginning in 1927. The trees treated consisted of Florida Common grapefruit, Pineapple and Valencia oranges, and a single tree of each of tangerine and Villa Franca lemon. Several trees at the west end of the grove were on sweet seedling orange stock while the remainder were on sour orange stock. The soil is Gainesville sand with some coquina limestone occuring within the root zone in places. The trees suffer from drought more or less prolonged periods each year. Numerous trees were removed from this grove on account of decline from blight and bark diseases over a period of several years prior to 1927 and several trees have died each year since then. As a result, by the end of 1937, more than half of the original trees of moderate age were removed and replanted. Many of the trees originally treated in 1927 had bark diseases so far advanced that they soon proved hopeless.

Of the 83 trees originally treated for bark diseases, 8 were found to have an undescribed zonate canker working in the crotches of the divisions of the trunks and main limbs, particularly where old stubs were left in pruning. This was caused by an unidentified perennial, brown polypore (**Poria** sp.) which resulted in the decay of the interior wood of the attacked trunks and main limbs. The trees on which this was the principal trouble were eliminated when the results were tabulated at the conclusion of the treatments in 1937, thus leaving a balance of 75 trees, of which 38 were grapefruit and 35 orange.

Of the 38 grapefruit trees treated for psorosis, 29, all of which had fairly bad to bad cases when first treated, were either removed or discarded during the period as worthless on account of decline from this trouble. Within 4 years after the initial treatment, 20, or 69 per cent, of the trees having well advanced cases of psorosis to start with were either removed or had declined so far as to be worthless. Three additional grapefruit trees were removed on account of decline from blight. In 2 grapefruit trees psorosis continued to show activity in 1937 and was not controlled. In the remaining 4 the disease appeared to be controlled at the final inspection in 1937. In 2 of these no activity of the disease was apparent for the last 8 years. Another showed no evidence of ac-

(Continued on page 19)

CONTROL MEASURES FOR RUST MITES

(Continued from page 15)

It is important that the sulfur be finely ground—the more finely the better, up to the limit where its cost becomes excessive. To make it go through the duster more effectively sulfur is commonly diluted with about five per cent of lime, in other words, five pounds of lime to 95 pounds of sulfur.

Sprays will be more effective for the 6-spotted mite, and special care must be taken to hit the undersides of the leaves. They must be thoroughly covered. Lime-sulfur is the spray which has been long used. Concentrations will vary from 1 to 40 at this time of the year to 1 to 65 or even 75. The higher concentrations, of course, are more liable to burn tender fruit and foliage, and the young leaves of grapefruit are tender at this time of the year so the higher concentrations should be avoided on grapefruit trees. During the last three years the practice has become general of putting into each 100 gallons of lime-sulfur from five to ten pounds of wettable sulfur. This serves two purposes. In the first place, the addition of this extra amount of sulfur enables the growers to cut down on the concentration of lime-sulfur and therefore have a safer spray. By using ten pounds of wettable sulfur per 100 gallons one can reduce the lime-sulfur content to as low as 1 to 65 or even 1 to 75 in hotter weather. This makes a much safer spray than the heavier concentrations of lime-sulfur. Wettable sulfur is also an excellent spreader, enabling one to get better coverage, which is one of the essentials of rust mite control, as well as that of red spiders.

At this time of the year rust mites are apt to be on the leaves and twigs as well as the old fruit and will soon be appearing on the young fruit, especially grapefruit, so very thorough coverage of the trees is essential.

The time is approaching, if not already here, when many growers will be spraying their trees with bordeaux as a control for melanose. This gives them an opportunity to make a combination spray for rust mites, as well as melanose. The bordeaux sticks to the trees and holds the sulfur so that the control spreads over a longer period of time. Wettable sulfur and bordeaux can also be added to zinc compounds if these are being sprayed on the trees.

Rust mites hit the pocketbook of the growers from four directions. In the first place, rusty fruit uniformly brings a lower price than bright fruit. Russet fruit is smaller than it would have been had rust mites kept off. The diminution in size may be largely in the thickness of the rind but it takes more rusty fruit to fill a box than it does bright fruit. Furthermore, many small fruits that might have been large enough to market had the rust mites been controlled, may remain so small as to be culls.

Rusted fruit will not keep as well as bright fruit; there is more decay in transit. It is very probable, though we have very little data on the subject, that rust mites also injure the leaves and general health of the tree. Leastwise, one who wishes to get most from his crop of citrus must control rust mites.

The season of the year when rust mites are most likely to be destructive is from now until sometime after the summer rains begin in June or July, although there is no season of the year when one can be perfectly secure from rust mites. The rainy season of the summer is least likely to have a heavy infestation of rust mites. However, the cessation of the rains for a week or ten days will often bring on an infestation even at that time.

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STUDY OF GUMMOSIS AND PSOROSIS

(Continued from page 17)

tivity for the last 8 years except for a new outbreak in 1936. The fourth showed no evidence of activity for the last 7 years except for a new outbreak in 1935. The results of the treatments of the grapefruit trees in this grove for psorosis are summarized in Table 4.

TABLE 4—Results of 11 years' treatment of 38 grapefruit trees for psorosis in grove at Bonaventure, beginning in 1927.

Year of inspection and retreatment	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	38	36	28	20	18	17	15	11	10	9
Trees not requiring retreatment	10	3	8	6	8	5	7	5	4	4
(Percentage)	or 26.3	or 8.3	or 28.6	or 30.0	or 44.4	or 29.4	or 46.6	or 45.5	or 40.0	or 44.4
Trees retreated because disease not checked by previous treatment	25	21	11	8	7	9	4	3	5	0
Trees retreated because of lesions developing at new points	1	4	1	4	2	1	0	2	0	2
Trees removed or discarded on account of decline from psorosis	2	8	8	2	1	0	3	1	1	3
Trees removed or discarded on account of decline from blight, etc.										

Of the 35 orange trees treated for psorosis, 9, all of which had fairly bad cases to start with, were either removed or discarded as worthless because of decline from this trouble. Eleven additional trees were either removed or discarded on account of decline from blight. When first treated in 1927 the psorosis on practically all of these trees was limited to from 1 to 4 small lesions, all apparently being of recent origin. It is therefore quite likely that, had these trees not declined from blight, the psorosis could have been cured readily by the treatment, especially as there had been no evidence of activity of this trouble in some of these trees for periods ranging from 1 to 6 years prior to their removal or discard on account of decline from blight.

Definite failure to control psorosis occurred only in a single one of the 16 orange trees remaining in 1937, and on this the disease continued to show activity most years since the original treatment, including 1937. Only one other of these trees required retreatment in 1937 and this resulted from the disease starting at a new point after there being no evidence of activity for 7 years. In the other 14 orange trees some required retreatment because the disease was not checked by the first treatment, and several because of the disease breaking out subsequently at new points after it had been arrested in the lesions originally treated. Of these 14 orange trees, 2, 2, 1, 3, 3, 2, and 1 showed no evidence of psorosis for the last 3, 4, 5, 6, 7, 9, and 10 years, respectively, following the initial treatment in 1927. The results of the treatments of the orange trees in this grove for psorosis are summarized in Table 5.

The gummosis on the single tangerine tree treated in this grove continued to show activity each year, either at the places originally treated or at new ones, until 1933, when it was discarded on account of decline from blight. The gummosis on the single lemon tree in this grove continued to show activity, either at old places treated or at new ones, almost every year, including 1937.

TABLE 5—Summary of 11 years' treatment of 35 orange trees for psorosis in grove at Bonaventure, beginning in 1927.

Year of inspection and retreatment	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Trees remaining at beginning of year	35	35	30	27	22	22	22	21	21	18
Trees not requiring retreatment	19	12	13	13	19	17	17	19	16	14
(Percentage)	or 54.3	or 34.3	or 43.3	or 48.1	or 86.4	or 77.3	or 77.3	or 90.5	or 76.2	or 77.7
Trees retreated because disease not checked by previous treatment	12	8	7	4	2	2	3	1	2	1
Trees retreated because of lesions developing at new points	4	10	7	5	1	3	1	1	0	1
Trees removed or discarded on account of decline from psorosis	0	4	1	2	0	0	0	0	1	1
Trees removed or discarded on account of decline from blight	0	1	2	8	0	0	1	0	2	1

While the treatment was absolutely ineffective in arresting the progress of the disease in this tree, the tree still continues to be productive.

During the 11-year period covered by the inspections and treatments 25 additional grapefruit and orange trees in this grove were added to the list of trees being treated for bark diseases. On 5 orange trees the trouble was merely zonate canker. The treatment of the balance of these trees for psorosis began as follows: 3 in 1928, 10 in 1929, 1 in 1930, 1 in 1931, 3 in 1935, and 2 in 1936. Of these 20 trees, 1 grapefruit and 1 orange were removed or discarded as worthless on account of decline from psorosis, and 2 grapefruit and 4 orange trees were removed or discarded on account of decline from blight. Of the remaining 12 trees, in 3 grapefruit and 1 orange the psorosis obviously was not controlled, while in 7 grapefruit and 1 orange tree there was no evidence of activity of the disease for periods ranging from 1 to 8 years. On some of the latter grapefruit trees the gumming appeared to be more typical of gummosis than psorosis. The results with these additional trees on which bark diseases developed since the initiation of the observations in 1927 clearly emphasize the fact that cases of psorosis and gummosis frequently can break out and develop with great rapidity in a very short time.

The bark-scraping method of treatment of the trees in this grove proved very effective, particularly on oranges, where the trees were treated before the disease made such headway as to become systemic and the interior wood of the trunks and main limbs became invaded by various organisms, after which the decline of the trees ensues rapidly. Much of the striking effect of the treatment was minimized, however, by the decline of a large number of trees from blight. The work in this grove shows clearly the utter futility of attempting to cure trees when the bark diseases have advanced to such a point that they are no longer amenable to treatment.

Grove at Cocoa

In this grove all trees in which gummosis and psorosis were apparent in a block of 28 rows of 11 trees each, were treated, beginning in 1928. This block consisted of mixed grapefruit, orange and tangerine trees of moder-

ate bearing age on sour orange stock. The soil is St. Lucie fine sand, comprising white sand with a grayish surface layer. This type of land is extremely droughty and the trees have been observed to suffer seriously from lack of moisture during more or less prolonged periods almost every year. A considerable number of trees had been removed from this block on account of decline from blight and psorosis when the experiment was begun. This grove has been given fairly good care but the trees have been greatly handicapped because of the droughtiness of the soil and lack of fertility and organic matter.

Of the 22 grapefruit trees originally treated in this block of grove in 1928, 4 appeared to have but slight to moderate cases of gummosis. In most of these the disease was checked for a time by the treatments but in all cases it broke out again later at other points, particularly the callus formed around old partially healed pruning wounds. Three of these trees had been free of any gumming for the last 6, 2 and 4 years, respectively, of the experiment, but the last-mentioned tree developed blight and was removed in 1937. The other one had not shown any evidence of gumming during the years from 1933 to 1936 inclusive, but developed a slight gumming through two small cracks in the callus around an old pruning wound in 1937.

Of the remaining grapefruit trees the gumming exhibited appeared to be typical of psorosis. One of these trees apparently had but a slight case in 1928, whereas the balance all had moderately advanced to bad cases. In most instances the disease continued to be more or less active each year, but sometimes appeared inactive. Even though apparently checked where treated on the trunks and main limbs, the disease tended to break out above the treated areas, beyond where it occurred previously. In practically all cases it appeared to be systemic and gradually became worse each year, especially during those years in which the trees suffered from drought. In some instances trees that were declining rapidly later improved temporarily, only to decline again later. Only one of these trees remained at the termination of the observations in 1937 and this appeared to be hopelessly involved. The others were removed or discarded as follows: 3 in 1929, 1 in 1930, 3 in 1931, 1 in 1932, 3 in in 1933, 2 in 1934, 2 in 1935 and 2 in 1937.

Of the 20 orange trees originally treated in this block of grove in 1928, one rather small tree which exhibited an advanced case of psorosis, was discarded in 1932 on account of decline from this trouble. The remainder of the orange trees all exhibited from 1 to 3 small psorosis lesions on the trunks or limb crotches when treated in 1928. Of these, 5 in which the disease obviously was controlled were later removed on account of decline from blight. Of the remaining 14 orange trees, all but one appeared free from psorosis at the end of the experiment in 1937. Of these 3 had not shown any evidence of the disease since the first treatment in 1928, and 2, 1, 5, 1, and 2 had not shown any evidence of the disease for the last 8, 7, 6, 3, and 2 years, respectively. In the case of the 2 trees that had not shown any evidence of psorosis during the last 2 years a slight new lesion, developed in 1935 in both instances, was the only evidence of the disease which these trees had shown since the original treatment in 1928. Thus the bark-scraping method of treatment appears to have been productive of excellent results on these orange trees which exhibited but early stage lesions of psorosis to begin with.

Of the 28 tangerine trees originally treated in this block in 1928, many showed a reoccurrence of the trouble 3 years later in the first bark lesions treated. When the results of the treatments were summarized at the conclusion of the experiment in 1937 it was found that in most instances these trees required retreatment nearly every year since the initial treatment. This was necessary either as a result of bark lesions developing at new points on the limbs or trunks, or small gumming spots developing in or adjoining previously treated areas, or both. As a result of the frequent exposure of these trees to drought, several began declining and developed abnormally small, hard-looking foliage exhibiting more or less frenching. By the final inspection in 1937, 10 of these trees had been removed as a result of this decline. These were removed or discarded as follows: 3 in 1930, 1 in 1932, 1 in 1933, 1 in 1934, 1 in 1935, and 3 in 1937. Another of these trees was discarded in 1931 because the tangerine limb being treated was cut off. The remaining 17 of these tangerine trees all required more or less retreatment in 1937, either as a result of bark lesions reoccurring in areas previously treated, or developing at new points or both. One of these trees was also observed to be declining at this time. In none of the 28 tangerine trees originally treated in this grove block, however, was the bark disease responsible for their death, nor did it appear to contribute particularly to their decline in any case.

It was of interest to note at the final inspection in 1937 that the bark disease in these tangerine trees probably was as active as it was in any year since the initial treatment was begun in 1928, and certainly much more so than it was in some years. The severity of this trouble the final year of the inspection may be due in part to the fact that it was not made until August 25. Had it been made prior to the active growing season of the trees, the disease undoubtedly would have made less headway since the retreatment of the previous year, as its greatest period of activity appears to be during the period of active growth of the trees. In any event, however, the results show that while the bark-scraping method of treatment readily checks the development of this disease in tangerine trees the trouble invariably develops anew in later years at points remote from the originally treated areas and also in the treated areas after the lapse of 3 or more years, when the lesions appear to have healed completely. Since the disease develops so consistently at new places on the trunks and limbs where it was not apparent in previous inspections, it appears that the new outbreaks which frequently develop in previously treated areas are not a result of the disease holding over in these particular areas for a few years after they appear to be completely healed or of the disease being systemic. Like psorosis, this bark disease of tangerine trees frequently develops in crotches of the trunk or limb divisions.

During the 10-year period a total of 7 trees, comprising 4 grapefruit, 2 oranges and 1 tangerine, was added to the list of trees being treated in this block of grove for bark diseases. Of the grapefruit trees, 2

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that developed typical gummosis in 1931 were cured, while in one that developed psorosis in 1931 the tree appeared to be hopeless by 1935 but was still doing fairly well in 1937. Another grapefruit tree on which an extensive case of psorosis was first noted in 1935, improved greatly in 1936 but evidently declined later, as it was removed in 1937. In one orange tree which developed psorosis in 1931 the tree had lost two of its main limbs and was declining by 1937, while in another which developed psorosis in 1936 the disease was still quite active in 1937. In the single tangerine tree first treated in 1929, retreatment was required each succeeding year as the disease, though responding nicely at the places treated, kept breaking out at new points on the trunk and limbs each succeeding year.

Discussion

The bark-scaling disease which has been so common on tangerine trees for many years in Florida is characterized by very little gum formation. Tangerine trees commonly have bad cases of this disease for several years without seriously affecting the life of the trees or curtailing crop production. This trouble, which was regarded by the writer some years ago as a form of psorosis, clearly is quite different from that trouble and will have to be regarded as a form of gumosis. Local lesions yield with great readiness to the bark-scraping method of treatment but, unfortunately, new diseased areas keep developing at points on the trunks and limbs which are often quite remote from the areas previously treated. The disease also frequently begins to develop anew in previously treated areas where the bark appears to have become perfectly smooth and healthy, 3 or more years after their treatment. In view of the pronounced tendency for this bark disease to thus keep breaking out anew, the treatment must be repeated each year in many cases in order to keep the disease under control.

It is clearly apparent from the work of the past 11 years that outbreaks of gumosis and psorosis are inclined to be more severe in some years than in others. While it was not possible to correlate this definitely with seasonal or other conditions, it was evident that both these bark diseases make greater headway after periods of drought or other conditions which weaken the trees. Both these bark diseases are most active throughout the spring and summer months, which comprise the active growing period of the trees. They are least active and frequently make little or no advance during the brief winter period, when the growth of the trees is reduced to a minimum. Lesions of both gumosis and psorosis which sometimes show little or no activity for periods of several months may become active at some later period when conditions are more favorable for development of these diseases.

The bark-scraping method of treatment has proved very effective in most cases in curing psorosis on orange trees and both gumosis and psorosis on grapefruit trees, provided the work be carefully and thoroughly done in the early stages of their development. By the time these bark diseases become systemic and areas of bark are killed to the wood and this becomes extensively invaded and discolored by various organisms, as reported by the writer* at the meeting of this Society 2 years ago, the treatment may possibly prolong the life of the trees somewhat but clearly is absolutely futile so far as saving the trees or affecting a cure is concerned. In not a single case has the writer succeeded in curing either an orange or a grapefruit tree where gummosis or psorosis has advanced to this point. In fact, in a few instances these diseases have progressed so rapidly that the bark-scraping method of treatment has not controlled them, even when attempted in what appeared to be a moderately early stage of the disease.

Aside from the basal form designated as foot-rot, gummosis does not seem to occur on orange trees in Florida but is of widespread occurrence on both grapefruit and lemon trees. The latter are very susceptible and they appear to be universally affected after they attain a few years of age. The disease often develops quite actively on certain trees in some years and appears much less serious on the same trees in others. While the trouble on lemons is quite difficult to cure, the trees frequently withstand it successfully for a good many years. On grapefruit trees gummosis often is more of less of a seasonal proposition. It frequently breaks out and develops with such great rapidity as to be quite alarming, often without any apparent reason, but later may cease activity and disappear without any special treatment, other than possibly some change in the fertilization or growing conditions. However, where areas of bark are killed down to the wood and the interior wood of the trunks and main limbs becomes invaded and discolored by various organisms the disease becomes systemic and the trees decline slowly but surely, despite treatment. Some of the gummosis on grapefruit trees in Florida is initiated by the common and well-known fungus, **Diplodia Natalensis.** Most of it, however, appears to start from purely physiological causes and conditions unfavorable to the best growth of the trees. Once the bark is ruptured by gum forming in pockets between it and the wood the way is paved for infection of both the bark and the wood by various organisms, which naturally aggravate the trouble. Even where recovery does take place, if extensive areas of bark are killed the wood of the trunks and main limbs frequently decays rapidly, which results in materially shortening the life expectancy of the trees.

Psorosis, on the other hand, is a much more serious disease in Florida and the cause of it is not yet clearly understood. Fawcett has presented considerable evidence to show that this is a virus disease which is transmitted chiefly through the selection of budwood from trees having the disease, and which frequently may not break out on the bark until the trees attain an age of as much as 8 or 10 years. Despite the widespread distribution of psorosis in many of our Florida groves, however, there appears to be no particular tendency for this disease to spread to trees immediately adjacent to the diseased ones, since new cases appear to develop without regard to the location of these. Psorosis is quite distinctive on orange trees but on grapefruit may be confused readily with gummosis. Extensive investigations will be required on all these bark diseases before we can expect to have a definite knowledge of their respective causes and the conditions favoring their development.

* Rhoads, Arthur S. Some new aspects of gummosis and psorosis of citrus trees in Florida. Florida State Hort. Soc. Proc. 49 (1936): 36-49, 4 pl.; also in Citrus Industry 17 (10): 6-7, 15, 19, 23, 4 figs. Oct., 1936.

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Control Of Melanose On Citrus

Dependent Upon Two Important Considerations, Spraying And Pruning. Treatment Discussed At The Meeting Of Florida State Horticultural Society Held In Winter Haven . . . By . . .

Wm. A. Kuntz and Geo. D. Ruehle

The control of melanose on citrus, under Florida conditions, has depended for a number of years on two important considerations. The first consideration involves the fact that the fungicides which are most effective in the control of disease require necessary increases in the measures for insect control. This first consideration, therefore, involves joint problems of disease and insect control. The present spray program as published by the Florida Citrus Commission has taken this in to account, and it is presented to you with the primary thought that insect control must be fully emphasized in each and all of the schedules. This phase of the problem is not considered in this paper, but is mentioned here, so that all of you may realize insect control is a part of the complete spray program for any disease control, and under our conditions it necessarily is a very essential part. The second consideration involves the comparative merits and values of spraying and pruning as methods of melanose control. In the study of the literature one is confronted by differences of opinion as to the relative values of pruning and spraying. These differences seem to be due not to the data as expressed, but rather to differences in opinion as to the fundamental reasons for spraying and pruning of citrus under our conditions. The purpose of the present paper is to analyze these two operations and to endeavor to show the relative merits of spraying and pruning as measures for melanose control.

The first record of any control of this disease is furnished by Swingle and Webber (5). In 1894, at Stanton, Florida, they demonstrated that melanose could be controlled by two applications of bordeaux mixture or ammoniacal solution of copper carbonate. They suggested that the first application be made about two weeks after the flowers had fallen, and the second about a month later. In 1911 Fawcett (2) recommended pruning of citrus as the first measure for the control of stem-end rot. A little later Floyd and Stevens (3), and still later Stevens (4) also emphasized pruning as a method for melanose control. Between 1920 and 1927, Burger, DeBusk and Briggs (1), and Winston and his associates (6, 7), emphasized the spraying of citrus for melanose control, almost to the exclusion of the pruning operations. The above notes are too brief to disclose the underlying reasons for these shifts in recommendations, but it seems logical that after the recommendations of Swingle and Webber, difficulty was encountered in the control of insects following the copper sprays. Floyd, and also Stevens, probably had to take this into account in their recommendations.They also made extensive studies of the causal organism of melanose and traced and described many new stages of this organism on citrus. From these studies, and largely because they had observed a very wide variation in the number of stages, they knew that spraying must have its limitations for the control of melanose. Because of these limitations Stevens concluded that pruning gave better control of the sum-total diseased conditions than could be secured with two sprays. On the other hand, Winston and co-workers pruned some seedling trees and found that pruning was expensive and unreliable for melanose control. In their spraying experiments they found that one or two applications of bordeaux-oil would produce bright fruit.

This brief review and the personal interpretation of the nature of the studies and the general results, clears up a number of points with regard to melanose control; it makes it clear that the measure which should be used depends upon the purpose. If the sole objective in melanose control is the production of bright fruit, then spraying is the method to be employed. If the objectives are the health and well-being of the tree through the elimination of diseased wood, then pruning is the practice is to be emphasized. And finally, if the objectives are broad enough to include both the health of the trees and the production of bright fruit, then effort must be made to maintain a balance in the spraying and pruning operations. A program which includes both spraying and pruning may seem impractical because of expense but research may further clarify the role of the various types of deadwood as producers of melanose spores and eventually simplify the problem of pruning. This dead wood phase of melanose development has always been considered as important, but its study is difficult and complex.

Some of the varying factors in the general field of citrus production show us why this problem is so complex. There are not only the extremes in the seasonal variations from month to month and from year year which must be taken into consideration, but there is also superimposed on these natural variations a complex of cultural practices. Thus over the complex of rains, temperatures, soil types, etc., on the one hand, there is thrown a greater complex of practices in fertilization, irrigation, cultivation and varieties of citrus so that we find it one of the most difficult problems in plant disease control. This double complex of variable factors must have a great influence on the growth and well-being of citrus trees; and the well-being of the tree is very closely connected with the diseased conditions. This is especially true of such a disease as melanose. The causal organism is constantly associated with citrus under Florida conditions, and it makes progressive inroads and becomes more active on the plants the moment they show signs of weakness.

Cold damage is one of the most serious problems of citrus production for it not only injures the tree, and possibly the crop, but also leaves

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Federal Trade Commission

Results Of Federal Trade Commission's Two-Year Investigation Of Agricultural Marketing

New York, July 21 — While the larger national fruit and vegetable auction markets were given a clean bill of health in their business conduct by the Federal Trade Commission, various abuses resulting in loss to growers of farm products were found in other phases of agricultural marketing in the report of its two-year investigation

The report was released through the efforts of Henry D. Greene, special representative of the American Fruit and Produce Auction Association. Greene went to Washington and made photostatic copies of the report which had been officially released but not publicly printed.

Charges made from a number of sources about two years ago led Congress to pass a resolution allotting money for the Federal Trade Commission investigation of terminal produce markets and auctions. These charges, answered in the report, included accusations of alleged unfair practices which resulted in instances where producers and shippers were defrauded.

Relating what it found wrong with agricultural marketing generally, the commission said:

"Packing, handling and transportation costs account for a large portion of the consumer's dollar and these costs are further pyramided by a large retail margin.

"The marketing of a large part of a crop is often controlled by those who have financed it and, in some cases, such financing is unfair and costly to the producers. The use of local production credit associations by associations of fruits, vegetables and grapes, should be encouraged.

"Uncoordnated transportation of produce by motor truck and the inability to forecast supplies moving in this manner has been shown to be one of the factors resulting in unstable markets subject to erratic price variations.

"The present inspection system is unsatisfactory and contributes to the payment of excessive claims for loss and damage in transit. Facilities in some of the principal terminal markets were found to be inadequate to handle the volume received, improperly located and poorly regulated."

"This condition," the report asserted, "contributes to inefficient methods of distribution, the existence of 'rackets,' and to an increased burden on both the consumer and producer."

In his copies of the report, Greene, who represents ten of the country's largest auction companies, found that the commission said, "The larger auction markets, properly regulated and conducted, afford a practical means by which fresh fruits can be sold efficiently." This conclusion is based uon the following considerations, the report shows:

"The auction method of selling permits disposal of large quantities of fruits and vegetables quickly and with competitive forces given more

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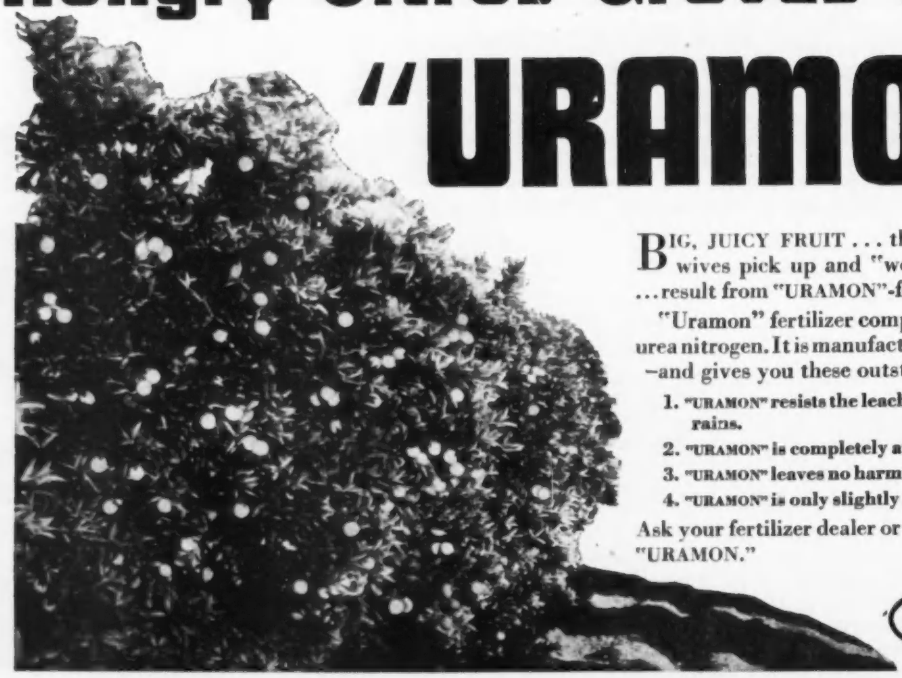

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